Towards a Non-verbal Enhanced Communication System

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Abstract
In the context of 3D-chatting and more generally in social CyberSpace forum involving virtual worlds, animation relative to non-verbal communication is almost fully omitted. This poster presents a work in progress that can help solving this issue with a system simulating a general process pipeline from dialog text, emotional extraction, emotional mind dynamic, to corresponding facial and full body animation of user’s avatar.

Categories and Subject Descriptors (according to ACM CCS): I.3.7 [Computer Graphics]: Animation
H.5.1Multimedia Information SystemsVirtual Realities J.4Social and behavioral sciences H.2.8Database ApplicationsData mining

Figure 1: Example of a 3D-chatting scenario involving animated non-verbal communication expressing three emotions, i.e. empathy, anger, and fear

1. Motivation and Goal

Non-verbal communication – Non-verbal communication is a wordless process of communication that mainly consists of animations: gaze, facial expressions, head and body orientation, and arms and hands movements (exception: voice tone). This conscious or unconscious way of communicating influences emotional state of all characters involved in a conversation – in our test case dialog. Non-verbal communication are triggered by emotional states, social customs, and personal attributes. In the context of computer graphics and virtual worlds, they strongly influence character animation, making the conversation alive, the scenarios more consistent, and the whole more ecologically valid.

Needs and issues – Entertainment and industrial applications involving 3D communication (e.g. Second LIFE®) start looking for solutions to simulate this key aspect of communication. The main issue is that trying to simulate non-verbal communication involves understanding “emotion”, which is not an easy task as this concept is not well defined even by specialists [Kap10, Ekm04]. Furthermore, in a context of virtual world, users cannot control every attributes – especially unconscious ones – of their avatars [GAP∗10, GAS∗11]. Hence, we have to develop models and algorithms that will simulate at least semi-automatically potential emotions and corresponding coherent non-verbal communication animations.

We describe here a work in progress that try to simulate the most important attributes of non-verbal communication:

- Virtual human (VH) emotional mind including 3D emotional axes – i.e. valence, arousal, and dominance – and 27 “emoMotions” that predefined full body VH (moCapped) seven second animations corresponding to emotional attitudes – light temper, sulky, enthusiastic, etc. – see figure 1 for fear, anger, and empathy;
- A virtual reality server-clients architecture enables to manage in real-time direct events and sub-events induced the emotional dynamic model (see next point);
- A formal approach to simulate emotional dynamic model...
enabling instantaneous emotions, long-term emotions, emotional memory link to specific encountered VH;

- Automatic gazing and speech target redirection;
- Facial expressions: simple or asymmetrical (bi-emotional).

2. Emotional Model

VH-emotional model – In a context of social simulation, at least three aspects of emotions have to be taken into account for simulating a virtual human emotional mind: the instantaneous emotion, the memory of affect-events, the long term emotion.

Instantaneous and long term emotions – Based on the affect parameters extracted using two large databases (i.e. data mining with “superClassifiers” and “ANEW” [TBP*10]), these emotions are detected within each separate sentences; the sum of these emotions influences long term emotions towards each encountered VH. Every dialog is stored by each VH depending on encountered VH. These data sets constitute the main source of emotional memory and are used to set initial emotional values of known VHs.

Emotion dynamics simulation – Virtual humans’ flow of emotion (valence, arousal, and dominance) are influenced by events, emotional parameters extracted from users’ input sentences, potential users’ emotional commands, time attenuation functions, and dialog directions (to whom it is addressed) [BW04].

Contributions to the field of animation – This system allows to manage, (also depending of user’s initial choice and on-the-fly command), fully or semi-automatically the animation of his/her avatar depending of the affects that are detected in the dialog. Influenced by current VH emotional state (i.e. long term emotions), instantaneous emotions first affect facial expression and when reaching threshold (pre-parameterized by user) can affect the entire body animation (see emotional motions). These specific (motion captured) emotional animations occur when reaching a threshold pre-defined by the user.

3. 3D Chatting Architecture

In the context of verbal and non-verbal communication, the virtual world must be and stay consistent. Therefore, the architecture is event-driven. The event manager is probably the main part of the architecture that guarantees: first, the correctness of time sequences; second, the coherence production of non-verbal sub-events; and third, the information transmission to clients (e.g. dialog, movements, collisions, self emotional states, others visible emotional change of emotion). The process pipeline from goals, potential events, to change of mind state, strongly influences the animated attitude of VHs, and basically makes them “alive”.

4. Results and Conclusion

Results are provided in the central area of the associated poster. The upper-left figure illustrates a typical CyberSpace conversation where non-verbal communications are omitted. The upper-right figure presents how emotions are managed by the computer (top, main step of the formal model) and by user (GUI). The bottom-left figure proposes possible applications of our non-verbal enriched 3D communication system. Finally, the bottom-right figure depicts relatively subtle non-verbal animation: (left) lateral facial expression induced by ambivalent emotion; (right) full-body animation relative to emotion (emoMotion): gaze, changing in head orientation, facial expressions (with asymmetry), and body language.

We have presented a work in progress consisting of a conversational system enriched with most attribute of non-verbal communication. This approach adds a new dimension to animation applicable to virtual worlds, especially 3D social networks.

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References


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